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LEVEL OF ABSTRACTION IN THE WRITTEN COMPOSITIONS OF CHILDREN VARYING IN INTELLIGENCE AND AGE.

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WRITTEN COMPOSITIONS WERE OBTAINED FROM 48 CHILDREN, FOUR FROM EACH AGE GROUP FROM EIGHT THROUGH 11, ASSIGNED TO THREE IQ GROUPS--RETARDED, NORMAL, AND SUPERIOR. USING SEVERAL OF THE FLESCH CRITERIA (WHICH USE NUMBER OF SYLLABLES, AVERAGE SENTENCE LENGTH, AND NUMBER OF DEFINITE WORDS AS INDICES), COMPOSITIONS WERE SCORED FOR DEFINITENESS OF STYLE. RESULTS INDICATED THAT TWO CRITERIA, DEFINITE WORDS AND FLESCH'S FORMULA R, WERE ASSOCIATED WITH MENTAL AGE AND IQ PROVIDED A MEANS FOR DISTINGUISHING COMPOSITIONS WRITTEN BY THE SUPERIOR IQ GROUP FROM THOSE WRITTEN BY THE NORMAL AND RETARDED CHILDREN. INCREASES IN AGE WERE NOT ASSOCIATED WITH INCREASES IN STYLISTIC GENERALITY FOR THE AGE RANGE SAMPLED. (AUTHOR/DL)

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May 15, 1967

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One aspect of research in verbal learning, written compositions, and prose writing in general deals with the efforts of many investigators to systematically define "level of abstraction". This terminology has been variously applied to "quality of ideation" (8), "linguistic maturity" (7), and "basic component of comprehension difficulty" (3). Such studies vary from the scaling of abstraction of single words (1, 2, 9) to the scaling of abstraction in written production (3, 4, 5, 6, 8, 10). For most investigators, abstraction denotes a reference continuum from specific to general or from sensory to non-sensory.

In a series of articles, Flesch (3, 4, 5) has provided several objective measures of comprehension difficulty and, according to Flesch, a major component of comprehension difficulty -- level of abstraction. Essentially, Flesch has suggested that word complexity, sentence complexity are associated with general referents and, more recently, that various parts of speech are associated with specific referents. As a measure of one aspect of writing style, specificity of content referents, certain of the Flesch indices may provide a useful means for describing growth and assessing change. The purpose of this paper is to determine whether or not level of abstraction provides a distinction between groups of children who vary in the way they use words in written production.

Specifically, the purpose of the paper is threefold:

1. To determine the degree of association between abstraction level in written composition, as measured by Flesch's definite words and abstraction formulas, and selected subject variables chronological age (CA), mental age (MA), and intelligence level (IQ).
2. To determine if there is a differential abstraction level in the written compositions of intellectually retarded, normal, and superior children.
3. To suggest a possible framework within which various syntactical elements in the Flesch formulas may be further evaluated.

Procedure

Forty-eight children, 24 boys and 24 girls, tested with the 1960 Revised Form of the Stanford-Binet Intelligence Test, formed a three group research design: retarded, IQ 85 or less; normal, 90 to 110; and superior, 120 and above. The respective IQ means were 76.56, 101.06, and 125.52. Each group consisted of four children at each year level from 8 to 11 for a total of 16 children per IQ group. A two-factor analysis of variance (IQ group x age level) indicated that the groups differed significantly on MA and IQ but not on CA; age levels differed on CA and MA but not on IQ.

The children were sampled from three counties in Georgia generally representing a middle to low-middle socioeconomic environment. In order to insure a sufficient sample of writing, that is, at least 100 words, two in-class themes were obtained from each child on the topics

"The Story I Like Best" and "A Trip to the Fair".

The Flesch Formulas

Two of Flesch's formulas and component parts of the formulas are of interest in this study:

$$\text{Formula A} = 206.835 - .846w1 - 1.015s1$$

$$\text{Formula R} = 169.095 + .532dw - .811w1$$

where

w1 = the number of syllables per 100 words
s1 = average sentence length in words per 100 words
dw = the number of definite words per 100 words

Formula A, introduced in 1948 as a measure of reading ease, and Formula R, introduced in 1950 as a measure of readibility, are given as measures of comprehension difficulty yielding scores along the same scale (3, 5):

Readibility Score or Reading Ease Score	Description of Style
0 to 30	Very difficult
30 to 50	Difficult
50 to 60	Fairly difficult
60 to 70	Standard
70 to 80	Fairly easy
80 to 90	Easy
90 to 100	Very easy

The distinction between the two formulas is related to Flesch's notion of abstraction as a basic component in comprehension difficulty. Formula R samples more of the "level of abstraction" component in comprehension difficulty than does Formula A, yet both still predict the

same Y[1], comprehension difficulty, or its inverse, reading ease. The two formulas, then, require three elements: number of syllables, average sentence length, and a count of definite words based on sixteen categories. To facilitate the analysis and to provide a managable profile of definite words, the sixteen categories were reduced to nine categories according to word function wherever possible.

1.	Nouns	1. names of people 2. natural gender nouns 3. nouns of time
2.	Adjectives	4. numeral adjectives 10. this, that, these, those; each, same, both, and 16. the plus noun modified
3.	Verbs	5. finite verb forms 6. present participles
4.	Pronouns	7. personal pronouns 12. possessive pronouns, and 13. that as relative pronoun
5.	Adverbs	8. here, there, then, now
6.	Wh-words	9. who, whom, when, where, why, and how
7.	Yes, No	14. yes, no
8.	Interjection	15. all interjections
9.	Interrogative	11. what, which

Results and Discussion

The results summarized in Tables 1, 2, and 3 provide correlational and two-factor variance analyses for the data. Table 1 confirms a significant negative relationship between IQ and total score of definite words. Formula R and Formula A show the same trend. Corresponding MA correlations suggest that definiteness in style,

holding topic constant, is related growth in intellectual performance. In addition, Flesch's notion that Formula R and A sample different components of abstraction may be supported to the extent that correlations between Formulas R and definite words with IQ are higher than Formula A with IQ. The correlation, however, between Formula A and Formula R, not reported in Table 1, is .84. Measures of complexity, sentence and word length, do not show very high relationships with subject variables, though sentence length with MA approaches significance.

The two-factor analysis of variance using formula components and formula scores as variables are reported in Table 2. The main effects for groups tend to be in the expected directions, that is, complexity as measured by word and sentence length, increases, and stylistic concreteness, as measured by definite words, Formula A, and Formula R, decreases. Standard deviations generally decrease across groups, indicating more homogeneous responding by normal and superior children. Significant effects obtained with definite words and Formula R supports the correlational analysis and indicates that these measures reflect stylistic differences in groups classified by IQ. T-test comparisons between groups on definite words and Formula R indicates that differences between retardates and normals do not quite reach significance but that both of these groups differ significantly from the superior group.

Main effects for age tend to be less predictable. From a mean high of 48.92 at age 8, definite words level off at a mean of 45 across the ages 9, 10, and 11. Obviously, it would be of interest to

follow the curve across an extended age range. Word length, sentence length, and Formula A are up one year, down the next. Overall, using age extremes 8 and 11, the results are generally what one would expect, increasing complexity and decreasing concreteness.

Table 3 summarizes the variance analyses using six reduced classes of definite words. Categories 7 (Yes, No), 8 (Interjection), and 9 (Interrogative) could not be included as variables due to infrequent occurance. Main effects across groups produce one significant variable, Adverbs, with the normal group relying more heavily upon this class then either retarded or superior groups. The tendency to use the word "than" may account for the higher usage in the normal group. Generally the first four variables, Nouns, Adjectives, Verbs, and Pronouns show decreasing mean and standard deviations across groups with Adjectives and Verbs quite close to .05 level. Wh-words, category 6, show no differential usage whatever.

Main effects for age indicates one significant variable, Pronouns, which increases from a mean of 11.08 at age 8 to a mean of 14.58 at age 10, then, declining significantly to 9.92 at age 11. In order to relate age to growth in stylistic generality, as measured by definite words, the definite words would have to indicate a sufficient decrement from year 8 to 11. The age effects, however, do not follow this pattern perhaps, again, because the age range is too limited or word function classification is inappropriate. Since the age effect for the sum of definite words shown in Table 2 was insignificant, it would be unlikely to find differences in the sum components. In short, the sum of these

definite words rather than separate categories seems to effect the best index for the study of stylistic definiteness.

Summary and Conclusions

Written compositions were obtained from 48 children assigned to three IQ groups. Compositions were scored for definiteness of style according to several of the Flesch criteria. The use of children differing in intellectual performance and age was based on the knowledge that stylistic differences would be present in their written production. Two of the Flesch criteria, definite words and Formula R, were associated with MA and IQ; further, definite words and Formula R distinguished compositions written by a superior group of children from those written by normal and retarded children, that is, the high IQ group used more general referents, in terms of the Flesch criteria, than the middle and low IQ groups. Increases in age were not associated with increases in stylistic generality for the age range sampled. A six category profile of definite words, reduced according to word function from sixteen, was offered; however, under the conditions of this study the reduced categories did not seem to provide additional information.

In conclusion, definite words and Formula R seem to be an adequate criteria for definiteness of style so as to justify further experimental usage. For example, the relationship between stylistic definiteness with other writing skills, theme topics, mode of discourse, and other age groups would be of interest. Broader applications within the field of communication seem equally possible.

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Footnotes

1. The formulas were constructed to predict grade level of children who could correctly answer three-fourths of the test questions about a given passage in McCall-Crabbs' Standard Test Lessons in Reading.

Table 1

Correlation of Subject and Formula Variables

	Definite Words	w1	s1	R	A
Subject Variable					
CA	-.05	.07	.17	-.08	-.12
MA	-.43*	.25	.36	-.44*	-.35
IQ	-.49*	.15	.26	-.53*	-.40*

*Significant at .01 level

Table 2

Means, Standard Deviation, and Results of Two-Factor Analysis of Variance (IQ Groups x Age Groups) on Formula Variables[1]

Formula Variables	Main Effect: Groups						
	Retarded		Normal		Superior		
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	F
Definite words*	50.88	9.99	47.38	5.04	40.31	5.25	.005
Word length	118.50	11.97	120.75	6.50	123.63	5.61	
Sentence length	8.30	2.27	8.64	2.27	9.99	2.72	
Formula A	98.17	10.67	95.92	5.38	92.11	5.61	
Formula R**	99.90	10.53	96.00	5.18	90.20	4.84	.01

Variables	Main Effect: Age								
	8		9		10		11		
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	F
Definite words	48.92	10.90	44.58	7.94	45.83	8.38	45.42	5.31	
Word length	120.58	6.11	118.83	6.89	120.25	7.11	124.17	12.77	
Sentence length	8.94	2.58	7.95	1.39	8.61	2.52	10.41	2.84	
Formula A	95.76	5.23	90.25	6.46	96.37	6.89	91.23	10.92	
Formula R	97.10	8.57	96.30	7.98	95.70	6.21	92.40	10.02	

[1]Interactions were not significant

*t.05: R=N; N>S; R>S
**t.05: R=N; N>S; R>S

Table 3

Means, Standard Deviations, and Results of Two-Factor Analysis of Variance (IQ Groups x Age Groups) on Part of Speech Variables[1]

Part of Speech Variables	Main Effect: Groups						
	Retarded		Normal		Superior		
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	F
1. Noun	7.75	5.10	8.69	4.31	5.75	3.82	
2. Adjective	13.25	9.53	9.69	3.28	8.63	4.74	
3. Verbs	14.81	3.90	13.25	2.17	12.38	2.96	
4. Pronoun	13.06	4.95	11.88	3.63	11.38	3.15	
5. Adverb*	.94	1.43	2.25	2.29	.88	1.14	.05
6. Wh-words	1.06	1.56	1.75	1.61	1.31	1.44	

Variables	Main Effect: Age								
	8		9		10		11		
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	F
1. Noun	7.67	5.14	4.42	1.72	7.50	4.68	10.00	4.34	
2. Adjective	4.00	7.71	10.33	7.03	8.50	6.05	9.25	4.63	
3. Verbs	13.00	3.90	13.92	2.39	13.58	4.03	13.42	2.42	
4. Pronoun**	11.08	4.01	12.83	2.75	14.58	3.60	9.92	4.12	.05
5. Adverb	2.00	2.21	1.67	1.89	.58	1.08	1.17	1.64	
6. Wh-words	1.08	1.72	1.75	2.09	1.08	1.31	1.58	.79	

[1]Interactions were not significant

*t.05: R=N; N>S; R=S
**t.05: 8=9; 9=10; 10>11